Small Business Innovation Research/Small Business Tech Transfer

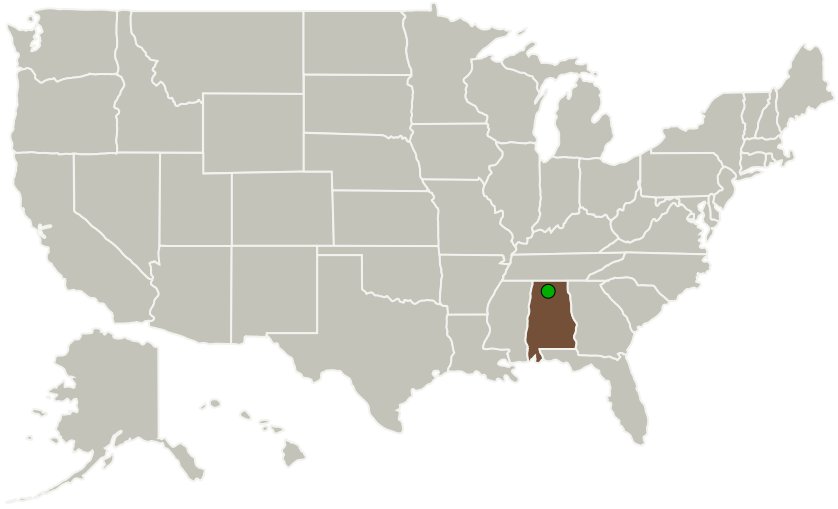
Solid Rocket Motor for Ultralow Temperature Operation During the Mars Sample Return Mission, Phase I

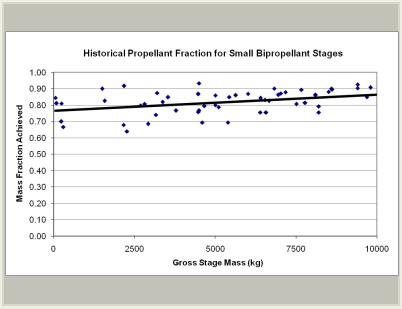
Completed Technology Project (2013 - 2013)

Project Introduction

A small Mars (or other celestial body) ascent vehicle is unlikely to achieve the necessary propellant fraction required to achieve orbit. Scaling down of liquid propulsion systems, as shown in the figure, is difficult. In the 100-kg class of vehicles, liquid propellant vehicle designers should expect a propellant fraction of only 0.75. In contrast, solid rocket motors (SRM) scale down much easier, so designers should expect a propellant fraction of at least 0.92. To be practical, however, the SRM must operate in extreme low temperature environments, which is difficult for state of the art polybutadiene binders. ASI proposes to develop a new, low temperature binder based upon siloxane. Siloxane polymers have glass transition temperatures below 150K, making them ideal for use on Mars with little or no external heaters required. A siloxane binder SRM-based MAV will easily achieve the propellant fraction needed for a sample return mission.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Analytical Services, Inc.(ASI)	Lead Organization	Industry Small Disadvantaged Business (SDB)	Huntsville, Alabama
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations
Alabama

Project Transitions

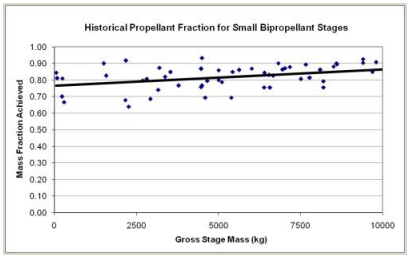
May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138517)*

Images



Project Image
Solid Rocket Motor for Ultralow Temperature Operation During the Mars Sample Return Mission *(https://techport.nasa.gov/image/130492)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Analytical Services, Inc. (ASI)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

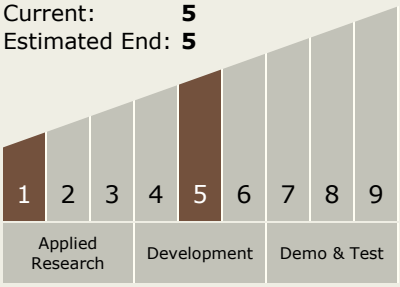
Carlos Torrez

Principal Investigator:

Robert Askins

Technology Maturity (TRL)

Start: **1**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System